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Misconception in exponential numbers in IST and IIND level primary school mathematics

Erdogan Mehmet Ozkan [a] *, Ayten Ozkan [a]

[a] *Yıldız Technical University,Department of Mathematics, Davutpasa Campus, İstanbul,34220, Turkey*

Abstract

The aim of this study was to determine misconceptions Ist and IInd level primary school students about exponential numbers. The sample of study consists of the students of a high school, 4 primary schools and a SBS and ÖSS training center. A questionnaire was administered to collect data. According to the result of the study, it is seen that the students have misconceptions about exponential numbers. Some solutions are recommended to those students to overcome such difficulties.

Keywords: *Mathematics Education, Root Numbers, Misconceptions;*

1. Introduction

The brain structure of human beings can classify the events finding the common points of thoughts, behaviors and objects. When observing the nature you see the similarities among the beings and common visions in the events. Even the limited observations are made you can make some generalizations and call them common name, these are concepts. In a more clear way the event, ideas and object groups that have the similar properties are called concept (Kaplan, 1998). The individuals learn his concepts and their names starting from the childhood (Turgut et al.,1997).

In a wide sense Misconception is the misunderstanding of the knowledge directly or wrong commending it indirectly. Misconceptions can be defined as knowledge of preventing to learn scientific truths and also are gained by the person through individual experiences. Misconceptions are the wrong concepts or conceptions that a person assumes it as true and uses as a habit. Misconceptions have different characteristic properties and differ from random mistakes. The person can realize the mistake and correct it by a little bit warning. But first of all the person who has a specific misconception tends to defend himself/herself when warned (Cankoy, 2000).

Powers are one of the subjects that the students have difficulties to learn. Although this subject is used in many disciplines of math ,this is thought as unnecessary, hard and complex concepts and operations not related to real life. The reason for negative thought is that they are not used in daily life so it stays abstract. These feelings may be caused by the lack of the feeling of the radicals. Also the students make some generalizations that have in integers, naturals and rational numbers (Duatepe-Paksu, 2008). One of the misconceptional subjects that we see in math lesson is powers. When the students can not correct the misconception on this subject they may have some problems for further subjects. In order to think, mind and reach the right judgment we must conceive what we learn.

* Erdoğan Mehmet Özkan Tel.: +090-212-383-4350
E-mail address: mozkan@yildiz.edu.tr

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The essence of the problems in math education is the inability of teaching basic concepts. In the primary education if the problem occurs it can be carried to intermediate or high school education. And related to this the problems of math have increased. It is aimed to understand and correct the misconceptions of the student that attend the 8.class (Ist level) and 9.class (IInd level).

The importance of math in the place or duration of education is great. The math in its own structure can affect the scientific study and technology as method and contends and so economical and social life. In spite of this we still have problems in math education. As long as the difficulties continue to learn basic concepts, It may not be possible to learn new concepts thoroughly. Powers are one of the math subjects that the students have problems. This subject is of great importance for the math education.

In order to determine the insufficiencies clearly and correct them we need many studies on this subject.

In this study it is aimed to

1. Determine the misconceptions of the students that attend the 8 and 9 class students having problems in powers
2. Contribute to correct these misconceptions.

2. Methodology

This study is aimed to determine the current situation and uses the test model. The working group consists of 3 high school, 4 primary school and some private courses (for high school and university entrance exams) in Istanbul.

There are 16 students for 8 and 9 class students .The students are randomly chosen 8 class students are 80 and the 9 class are 50 students. The questions are classified as primitive and nonprimitive. (Graeber & Tirosh, 1991).

2.1. Findings

In order to reach the goal of the study there have been established subproblems and searched for the answers:

What is the misconception that the students have determining the value of the power?
What is the misconception of understanding the zeroth power?
What is the misconception to distinguish $(-a)^n$ and $-a^n$
What is the misconception to conceive the negative power?
What the misconception to distinguish x^n and n^x
What is the misconception when the power is even?
What are the misconceptions that the students are faced with the summation and subtraction?
What is the misconception that the students are face with the multiplication and division?
What is the misconception that the students have while taking the power of the powers?

In the application the questions were collected 9 groups and the subjects are given the table1.

Table 1. The subjects of the questions

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Finding the value of the power	x														x	
Conceiving the meaning of the power 0		x											x			
Distinguishing the numbers $(-a)^n$ and $-a^n$			x													x
Understanding the negative power				x								x				
Distinguishing the concepts x^n and n^x					x											
Realizing the positiveness when the power is even						x										
Addition and subtraction operations								x		x						
Multiplication and division operations									x		x					
The operations of the powers of the power							x							x		

2.1.1. The misconceptions to find the value of the powers

Question 1. 2^3 = ? (Primitive)

Question 15. $(1,2)^2$ = ? (Nonprimitive)

In the question asken to determine the misconceptions of the value of the powers, %47 of the 8 class students have misconceptions in the primitive question while %62.5 have in non primitive question. The ratios for 9 class are %24 and %54

2.1.2. The misconceptions to understand the power 0

Question 2. 8^0 = ? (Primitive)

Question 13. $(0,256)^0$ = ? (Nonprimitive)

8 class students have the misconception of %40 in the primitive question whilw the ratio is %73 in the non primitive question. The ratios for 9 class students are %20 and %30.

2.1.3. The misconception to distinguish $(-a^n)$ and $-a^n$

Question 3. $(-9)^3+(-9^2)$ = ? (Primitive)

Question 16. $(-0,1^2)-(-0,1)^2$ = ? (Nonprimitive)

8 class students have misconception of %72 in the primitive and %85 in the nonprimitive question while the ratios for 9 class students are %60 and %50 respectively)

2.1.4. The misconception of the negative power

Question 4. $3^{-4} + (-2)^{-2}$ = ? (Primitive)

Question 12. $(0,2)^{-2} \div (-0,4)^{-1}$ = ? (Nonprimitive)

8 class students have misconception of %75 in the primitive and %80 in the nonprimitive question while the ratios for 9 class students are %54 and %64 respectively.

2.1.5. The misconception to distinguish x^n and n^x

Question 5. $2^{x+3}=64$ ise x^2=? (Nonprimitive)

8 class students have misconception of %75 while the ratios for 9 class students have %44

2.1.6. The misconception of the posiveness when the power is even

Question 6. $\frac{(-1)^{2001}+(-1)^{2010}+(-1)^{102}}{(-1)^{2008}-(-1)^{2003}}$ =? (Nonprimitive)

8 class students have misconception of 30 while the ratio for 9 class students is %24 respectively.

2.1.7. The misconceptions of the addition and subtraction

Question 8. $\frac{2^4+2^4}{3^2+3^2+3^2}$ **=? (**Primitive)

Question 10. $\frac{0,005.10^{-2}-0,03.10^{-3}}{0,1.10^{-5}+0,0001.10^{-2}}$ **=?** (Nonprimitive)

8 class students have misconception of %67,5 in the primitive and %85 in the nonprimitive question while the ratios for 9 class students are %64 and %47,5 respectively.

2.1.8. The misconceptions of the product and division

Question 9. $\frac{3^{-2}.5^4.2^4}{10^2.9^3}$ =? (Primitive)

Question 11. $\frac{-(0,2)^2.10^{-3}.(0,05)^3}{(0,008)^2}$ =? (Nonprimitive)

8 class students have misconception of %65 in the primitive and %85 in the nonprimitive question while the ratios for 9 class students are %40 and %48 respectively. Here the rules for the product or division of the powered numbers were generalized when the bases are different but the powers the same.

2.1.9. The misconceptions of the powers of the power

Question 7. $(2^2)^3 - (-4^2)^{-1}$ = ? (Primitive)
Question 14. $(0,002)^{-4}+(-0,3^2)^3$= ? (Nonprimitive)
8 class students have misconception of %62 in the primitive and %83 in the nonprimitive question while the ratios for 9 class students are %44 and %68 respectively.

3. Conclusion and Recommendings

In this study we see that 8 class students have much more misconceptions than 9 classes. The reason for it is that the education system is based on memorizing and so it is not possible to think abstract. And also we see that science students in the high school are better than others.

Lack of knowledge plays an important role for the misconceptions. When not learning the powers well, there may be problems with integers, rationals and their operations and absolute value. The reason for it we can say that teachers apply the traditional methods and the books are far away from being interesting. As long as it goes on in that way the problems get bigger because of the nature of math. When this happen student may think that their failure is caused by their untalent and so having fixed ideas and tend to away from the subject.

The precautions to correct these things and make the education meaningful are given as follows:
Before preciding to powers the students must solve problems on rationales and integers to get accustomed to it. It is important to be ready for the subject. The operations on these subjects must be supported by conceptional learning and reasoning is important. When this happens the students will be more conscious to apply the rules to powers.

Realizing these difficulties given above in order to take necessary precautions we must give appropriate homework. We must be careful where possible mistakes occur. And also some events must be possible in the class about the rules that the students know well.

While teaching the powers and operations, we must apply some quizzes for the students. This application makes the students always ready and leaves the knowledge to stay in their minds forever. These tests must contain open edged questions so avoiding memorizing.

Talking, discussing, writing and listening about math may help the students to learn the subject better and so we must keen on these while teaching powers (MEB,2005a;2005b). Teachers teaching techniques affect the level of interests. The teacher must not use a constant method and maket he students to join the lesson and use the techniques in accordance with it.

In spite of making the students to memorize the formulas we must teach them how to derivate these formulas using their own knowledge. When it happens the students remember all the things they learned and so the misconceptions are decreased. While you have the environment for the conceptional learning it will be possible to determine their misconceptions in their own language.

Taking out the powers from their abstraction will decrease the misconceptions. At the same time in the primary education math program (MEB 2005a) it is proposed to use technology to handle the misconceptions. Using the opportunities that the technology gave us we can improve the teaching methods and make the students more active. Also some social based students may love math if they use the calculator.

Math must be explained by the math teachers. In schools it must be taught by its own teacher and the the teachers must always be improved by some seminars.

The number of students in the classrooms must be decreased and every branch must have its own class. In the math class there must be visual and audial materials and some gadgets to use to make the abstract concepts concrete. These can be reached by the students and teachers whenever needed.

Finally math teachers must be in contact with each other and have some dialogs and share their experiences and gadgets to handle these misconceptions.

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